State of California
The Resources Agency
Department of Water Resources

INTERIM REPORT
SP-T7

PROJECT EFFECTS ON NOXIOUS TERRESTRIAL AND AQUATIC PLANT SPECIES

Oroville Facilities Relicensing
FERC Project No. 2100

APRIL 18, 2003

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REPORT SUMMARY

Land management activities, the associated clearing of land within the project boundaries, and the altered hydrology within Lake Oroville and downstream Feather River from the Oroville Facilities have the potential to enhance the establishment and spread of noxious weeds. Non-native plant species can adversely impact native plant species and communities and wildlife habitat (including State and federally listed species) through competition. Progress to date on this study include:

- Species lists have been compiled from the California Department of Food and Agriculture, California Exotic Pest Plant Council, and the Plumas National Forest noxious weed lists.
- Noxious weed species mapping began in 2002 in conjunction with SP-T2, SP-T3/5, and SP-T4 studies. Mapping is ongoing and will continue through the 2003 field season. Species mapped so far have been entered into a GIS.
- A literature review for high priority species has been completed.
- Evaluation of each of species has begun. Those completed are included in this report.

Noxious weed species occur throughout the project area, however, most of these species are common throughout California. Many of the species have been in the area for a number of years, others have recently colonized the area and are rapidly expanding their range. Findings to date include:

- Noxious weed species found within the Oroville Wildlife Area include giant reed, purple loosestrife, tree-of-heaven, scarlet wisteria, and yellow starthistle.
- Control efforts for purple loosestrife have been initiated by the Department of Fish and Game and the Department of Parks and Recreation in conjunction with the Butte Weed Management Area.
- Preliminary data indicate flows in the low-flow section of the Feather River may enhance the establishment of scarlet wisteria.
- Efforts to control some species of concern should be initiated throughout the Oroville Wildlife Area, Thermalito Afterbay, and Thermalito Forebay.
- Noxious weed species are less prevalent and present fewer problems above Oroville Dam than below.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 BACKGROUND INFORMATION

Land management activities, the associated clearing of land within the project boundaries, and the altered hydrology within Lake Oroville and downstream Feather River from the Oroville Facilities have the potential to enhance the establishment and spread of noxious weeds. Non-native plant species can adversely impact native plant species and communities and wildlife habitat (including State and federally listed species) through competition. The federal Endangered Species Act requires an evaluation of project-related impacts to federally listed species through competition and habitat degradation. This includes land disturbances and other project operations that favor non-native species over listed species and project operations that influence the dispersal of noxious weed species into downstream waters.

1.1.2 Study Area

The study area includes all areas within 0.5 miles of the Oroville Facilities Project 2100 boundary, including associated irrigation canals, and downstream Feather River levees to the confluence with the Yuba River.

1.2 DESCRIPTION OF FACILITIES

The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to store and distribute water to supplement the needs of urban and agricultural water users in northern California, the San Francisco Bay area, the San Joaquin Valley, and southern California. The Oroville Facilities are also operated for flood management, power generation, to improve water quality in the Delta, provide recreation, and enhance fish and wildlife.

FERC Project No. 2100 encompasses 41,100 acres and includes Oroville Dam and Reservoir, three power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant), Thermalito Diversion Dam, the Feather River Fish Hatchery and Fish Barrier Dam, Thermalito Power Canal, Oroville Wildlife Area (OWA), Thermalito Forebay and Forebay Dam, Thermalito Afterbay and Afterbay Dam, and transmission lines, as well as a number of recreational facilities. An overview of these facilities is provided on Figure 1.2-1. The Oroville Dam, along with two small saddle dams, impounds Lake Oroville, a 3.5-million-acre-feet (maf)

capacity storage reservoir with a surface area of 15,810 acres at its normal maximum operating level.

The hydroelectric facilities have a combined licensed generating capacity of approximately 762 megawatts (MW). The Hyatt Pumping-Generating Plant is the largest of the three power plants with a capacity of 645 MW. Water from the six-unit underground power plant (three conventional generating and three pumping-generating units) is discharged through two tunnels into the Feather River just downstream of Oroville Dam. The plant has a generating and pumping flow capacity of 16,950 cfs and 5,610 cfs, respectively. Other generation facilities include the 3-MW Thermalito Diversion Dam Power Plant and the 114-MW Thermalito Pumping-Generating Plant.

Thermalito Diversion Dam, four miles downstream of the Oroville Dam creates a tail water pool for the Hyatt Pumping-Generating Plant and is used to divert water to the Thermalito Power Canal. The Thermalito Diversion Dam Power Plant is a 3-MW power plant located on the left abutment of the Diversion Dam. The power plant releases a maximum of 615 cubic feet per second (cfs) of water into the river.

The Power Canal is a 10,000-foot-long channel designed to convey generating flows of 16,900 cfs to the Thermalito Forebay and pump-back flows to the Hyatt Pumping-Generating Plant. The Thermalito Forebay is an off-stream regulating reservoir for the 114-MW Thermalito Pumping-Generating Plant. The Thermalito Pumping-Generating Plant is designed to operate in tandem with the Hyatt Pumping-Generating Plant and has generating and pump-back flow capacities of 17,400 cfs and 9,120 cfs, respectively. When in generating mode, the Thermalito Pumping-Generating Plant discharges into the Thermalito Afterbay, which is contained by a 42,000-foot-long earth-fill dam. The Afterbay is used to release water into the Feather River downstream of the Oroville Facilities, helps regulate the power system, provides storage for pump-back operations, and provides recreational opportunities. Several local irrigation districts receive water from the Afterbay.

The Feather River Fish Barrier Dam is downstream of the Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the low-flow channel of the Feather River between the dam and the Afterbay outlet, and provides attraction flow for the hatchery. The hatchery was intended to compensate for spawning grounds lost to returning salmon and steelhead trout from the construction of Oroville Dam. The hatchery can accommodate an average of 8,000 adult fish annually.

The Oroville Facilities support a wide variety of recreational opportunities. They include: boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, hunting, and visitor information sites with cultural and informational displays about the developed facilities and the natural environment.

There are major recreation facilities at Loafer Creek, Bidwell Canyon, the Spillway, North and South Thermalito Forebay, and Lime Saddle. Lake Oroville has two full-service marinas, five car-top boat launch ramps, ten floating campsites, and seven dispersed floating toilets. There are also recreation facilities at the Visitor Center and the OWA.

The OWA comprises approximately 11,000-acres west of Oroville that is managed for wildlife habitat and recreational activities. It includes the Thermalito Afterbay and surrounding lands (approximately 6,000 acres) along with 5,000 acres adjoining the Feather River. The 5,000 acre area straddles 12 miles of the Feather River, which includes willow and cottonwood lined ponds, islands, and channels. Recreation areas include dispersed recreation (hunting, fishing, and bird watching), plus recreation at developed sites, including Monument Hill day use area, model airplane grounds, three boat launches on the Afterbay and two on the river, and two primitive camping areas. California Department of Fish and Game's (DFG) habitat enhancement program includes a wood duck nest-box program and dry land farming for nesting cover and improved wildlife forage. Limited gravel extraction also occurs in a number of locations.

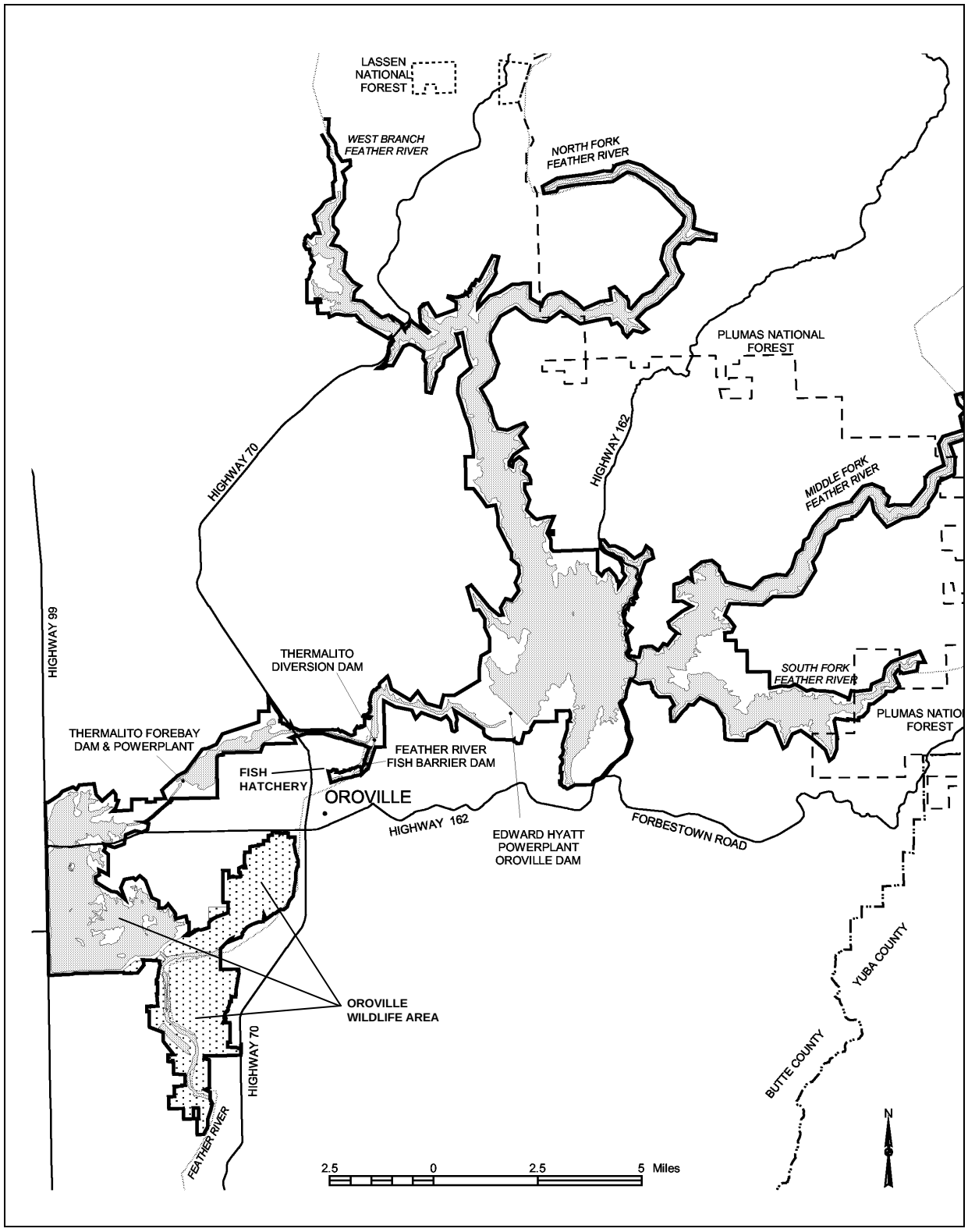

Figure 1.2-1. Oroville Facilities FERC Project Boundary

1.3 CURRENT OPERATIONAL CONSTRAINTS

Operation of the Oroville Facilities varies seasonally, weekly and hourly, depending on hydrology and the objectives DWR is trying to meet. Typically, releases to the Feather River are managed to conserve water while meeting a variety of water delivery requirements, including flow, temperature, fisheries, recreation, diversion and water quality. Lake Oroville stores winter and spring runoff for release to the Feather River as necessary for project purposes. Meeting the water supply objectives of the SWP has always been the primary consideration for determining Oroville Facilities operation (within the regulatory constraints specified for flood control, in-stream fisheries, and downstream uses). Power production is scheduled within the boundaries specified by the water operations criteria noted above. Annual operations planning is conducted for multi-year carry over. The current methodology is to retain half of the Lake Oroville storage above a specific level for subsequent years. Currently, that level has been established at 1,000,000 acre-feet (af); however, this does not limit draw down of the reservoir below that level. If hydrology is drier than expected or requirements greater than expected, additional water would be released from Lake Oroville. The operations plan is updated regularly to reflect changes in hydrology and downstream operations. Typically, Lake Oroville is filled to its maximum annual level of up to 900 feet above mean sea level (msl) in June and then can be lowered as necessary to meet downstream requirements, to its minimum level in December or January. During drier years, the lake may be drawn down more and may not fill to the desired levels the following spring. Project operations are directly constrained by downstream operational constraints and flood management criteria as described below.

1.3.1 Downstream Operation

An August 1983 agreement between DWR and DFG entitled, “Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife,” sets criteria and objectives for flow and temperatures in the low flow channel and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement: (1) establishes minimum flows between Thermalito Afterbay Outlet and Verona which vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood management, failures, etc.; (3) requires flow stability during the peak of the fall-run Chinook spawning season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the later spring/summer for shad and striped bass.

1.3.1.1 Instream Flow Requirements

The Oroville Facilities are operated to meet minimum flows in the Lower Feather River as established by the 1983 agreement (see above). The agreement specifies that Oroville Facilities release a minimum of 600 cfs into the Feather River from the

Thermalito Diversion Dam for fisheries purposes. This is the total volume of flows from the diversion dam outlet, diversion dam power plant, and the Feather River Fish Hatchery pipeline.

Generally, the instream flow requirements below Thermalito Afterbay are 1,700 cfs from October through March, and 1,000 cfs from April through September. However, if runoff for the previous April through July period is less than 1,942,000 af (i.e., the 1911-1960 mean unimpaired runoff near Oroville), the minimum flow can be reduced to 1,200 cfs from October to February, and 1,000 cfs for March. A maximum flow of 2,500 cfs is maintained from October 15 through November 30 to prevent spawning in overbank areas that might become de-watered.

1.3.1.2 Temperature Requirements

The Diversion Pool provides the water supply for the Feather River Fish Hatchery. The hatchery objectives are 52°F for September, 51°F for October and November, 55°F for December through March, 51°F for April through May 15, 55°F for last half of May, 56°F for June 1-15, 60°F for June 16 through August 15, and 58°F for August 16-31. A temperature range of plus or minus 4°F is allowed for objectives, April through November.

There are several temperature objectives for the Feather River downstream of the Afterbay Outlet. During the fall months, after September 15, the temperatures must be suitable for fall-run Chinook. From May through August, they must be suitable for shad, striped bass, and other warmwater fish.

The National Marine Fisheries Service has also established an explicit criterion for steelhead trout and spring-run Chinook salmon. Memorialized in a biological opinion on the effects of the Central Valley Project and SWP on Central Valley spring-run Chinook and steelhead as a reasonable and prudent measure; DWR is required to control water temperature at Feather River mile 61.6 (Robinson's Riffle in the low-flow channel) from June 1 through September 30. This measure requires water temperatures less than or equal to 65°F on a daily average. The requirement is not intended to preclude pump-back operations at the Oroville Facilities needed to assist the State of California with supplying energy during periods when the California ISO anticipates a Stage 2 or higher alert.

The hatchery and river water temperature objectives sometimes conflict with temperatures desired by agricultural diverters. Under existing agreements, DWR provides water for the Feather River Service Area (FRSA) contractors. The contractors claim a need for warmer water during spring and summer for rice germination and growth (i.e., 65°F from approximately April through mid May, and 59°F during the remainder of the growing season). There is no obligation for DWR to meet the rice

water temperature goals. However, to the extent practical, DWR does use its operational flexibility to accommodate the FRSA contractor's temperature goals.

1.3.1.3 Water Diversions

Monthly irrigation diversions of up to 190,000 (July 2002) af are made from the Thermalito Complex during the May through August irrigation season. Total annual entitlement of the Butte and Sutter County agricultural users is approximately 1 maf. After meeting these local demands, flows into the lower Feather River continue into the Sacramento River and into the Sacramento-San Joaquin Delta. In the northwestern portion of the Delta, water is pumped into the North Bay Aqueduct. In the south Delta, water is diverted into Clifton Court Forebay where the water is stored until it is pumped into the California Aqueduct.

1.3.1.4 Water Quality

Flows through the Delta are maintained to meet Bay-Delta water quality standards arising from DWR's water rights permits. These standards are designed to meet several water quality objectives such as salinity, Delta outflow, river flows, and export limits. The purpose of these objectives is to attain the highest water quality, which is reasonable, considering all demands being made on the Bay-Delta waters. In particular, they protect a wide range of fish and wildlife including Chinook salmon, Delta smelt, striped bass, and the habitat of estuarine-dependent species.

1.3.2 Flood Management

The Oroville Facilities are an integral component of the flood management system for the Sacramento Valley. During the wintertime, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE). Under these requirements, Lake Oroville is operated to maintain up to 750,000 af of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by the USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with the USACE.

The flood control requirements are designed for multiple use of reservoir space. During times when flood management space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through March, the maximum allowable storage limit (point at which specific flood release would have to be made) varies from about 2.8 to 3.2 maf to ensure adequate space in Lake Oroville to handle flood flows. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry while maintaining adequate flood protection. When the wetness index is high in the basin (i.e., wetness in the

watershed above Lake Oroville), the flood management space required is at its greatest amount to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next flood season. During flood events, actual storage may encroach into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

2.0 NEED FOR STUDY

Relicensing participants have identified land management practices, clearing of land within the project boundary, and altered hydrology downstream of the Oroville Facilities as activities that have the potential to affect noxious weeds. Non-native plant species can adversely impact native plant species and communities (including State and federally listed species) through competition. The federal Endangered Species Act requires an evaluation of project-related impacts to federally listed species through competition and habitat degradation. This includes land disturbances and other project operations that favor non-native species over listed species and project operations that influence the dispersal of noxious weed species into downstream waters.

The maps produced from this study will provide information on the distribution and extent of noxious weed locations within the project area. This information will help address continuing effects to native plant and animal habitats and riparian resources from water fluctuations, recreation, and other project-related activities. This data, together with other study results, will provide baseline conditions for assessing potential management actions.

These mapping efforts will be coordinated with mapping studies in SP T4 (vegetation and wildlife habitat) and in conjunction with other plant species inventories produced in SP T1 and SP T2. This information will provide relicensing participants with information on the distribution of noxious weeds in areas affected by project operations as well as their life history and dispersal mechanisms relative to project-related land management practices.

3.0 STUDY OBJECTIVE(S)

The objectives of this study are to provide sufficient information to 1) allow habitat analysis of species listed under the Endangered Species Acts; 2) allow State and federal agencies to comply with State and federal noxious weed legislation; 3) address the concerns of stakeholders relating to the infestation and spread of noxious weeds associated with ongoing and future project operation and maintenance activities; and 4) identify potential protection, mitigation, and enhancement measures.

4.0 METHODOLOGY

Task 1: Literature search and list of high priority noxious weed species expected to occur within the study area.

A list of noxious weed species that have potential for occurring in the project-affected area will be produced. This list is being developed from the California Department of Food and Agriculture (CDFA 2001, 2002), California Exotic Plant Pest Council (CalEPPC/Pest Plant List 1999), the U.S. Department of Agriculture (USDA), and the Plumas National Forest (Plumas National Forest 1998). This list will be updated periodically throughout the study to include additions or status changes. Lists may include additional invasive plant species of concern to local irrigation districts and State and federal agencies.

Literature surveys include information on the biology and ecology of each noxious weed species, dispersal mechanisms in relation to project operations, control measures, and current management activities within and near the project area.

Task 2: Species surveys and data collection.

Surveys for noxious weed species are being conducted concurrently with vegetation mapping (Study Plan T4) and special-status plant species surveys (Study Plan T2). All weed species are being noted in the floristic surveys, however, only high priority species will be mapped. These include CDFA List A and B, Cal EPPC List A1/2 and Red Alert species, and other species of concern to local irrigation districts and State and Federal land management agencies. All species on the PNF noxious weed lists will be surveyed for on National Forest Lands within the study area. Voucher specimens for these species, when collected, will be deposited with the Feather River Ranger District. All other voucher specimens will be deposited with the CSU Chico Herbarium. Surveys are being conducted during the appropriate time of year for proper identification of each species.

Data are being collected in the field by hand mapping on 1:5,000 rectified color aerial photograph maps and/or by using a mapping grade Global Positioning System (GPS) unit (3-m accuracy). According to weed mapping standards, data are being be collected as points, lines, or as area features (CDFA/Weed Mapping Handbook 2002, North American Weed Management Association 2003). The following cover classes (percent coverage) will be used to describe the density of the infestations:

T = trace; less than 1% cover
1 = low; occasional plants; between 1% and 5% cover

2 = moderate; scattered plants; between 5% and 25% cover
3 = high; fairly dense; between 25% and 50% cover
4 = dense; 50% to 75% cover
5 = very dense; 75% to 95% cover
6 = solid stand; 95% to 100%cover

Task 3: Computer mapping and coverage tables

The information collected in the field is being entered into a Geographic Information System (GIS) using Arcview software. Maps of noxious weed species distribution and associated acreage tables will be produced.

5.0 STUDY RESULTS

This report is an account of progress to date. Tasks 1, 2, and 3 have been initiated but are not completed.

5.1 TASK 1:

Noxious weed species that have potential for occurring in the project-affected area are included in Table 5.1-1. This list was updated in January 2003.

Table 5.1-1. noxious weed species that have potential for occurring in the project-affected area.

Scientific Name Common Name	CDFA List[1]	CalEPPC List[2]	Habitat (elevation)
Aegilops cylindrica Jointed goatgrass	B		Disturbed dry sites, cultivated fields (<1500m)
Aegilops triuncialis Barbed goatgrass	B		Disturbed sites, cultivated fields, roadsides (<1000m)
Ailanthus altissima Tree of heaven		A-2	Disturbed urban areas, waste places, riparian areas, grasslands (<1250m)
Arundo donax Giant reed		A-1	Moist places, seeps, ditchbanks (<500m)
Bassia hyssopifolia Five-horn bassia		B	Disturbed sites, fields, roadsides (<1200m)
Brassica nigra Black mustard		B	Fields, disturbed areas (<1500m)
Bromus madritensis ssp. rubens Red brome		A-2	Open, disturbed places (<2200m)
Bromus tectorum Cheat grass		A-1	Open, disturbed places (<2200m)
Cardaria chalepensis Lens-podded hoarycress	B	B	Disturbed, gen saline soils, fields (<1500m)
Cardaria pubescens *Whitetop*	B		Saline soils, fields, ditchbanks (<2000m)
Carduus pycnocephalus Italian thistle	C	B	Roadsides, pastures, waste areas (<1000m)
Centaurea calcitrapa Red star-thistle	B	B	Disturbed places (<1000m)
Centaurea maculosa Spotted knapweed	A	Red Alert	Disturbed areas (<2000m)
Centaurea melitensis Tocalote		B	Disturbed fields, open woods (<2200m)
Centaurea solstitialis	C	A-1	Pastures, roadsides, disturbed

Scientific Name Common Name	CDFA List[1]	CalEPPC List[2]	Habitat (elevation)
Yellow starthistle			grassland or woodland (<1300m)
Chondrilla juncea	A		Disturbed places
Skeleton weed			(<600m)
Cirsium arvense	B	B	Disturbed places
Canada thistle			(<1800m)
Cirsium vulgare		B	Disturbed places
Bull thistle			(<2300m)
Conium maculatum		B	Moist, disturbed places
Poison hemlock			(<1000m)
Convolvulus arvensis	C		Orchards, gardens
Field bindweed			(gen <1500m)
Coronopus squamatus	B		Disturbed places, fields
Swine cress			(<2300m)
Cortaderia jubata		A-1	Disturbed sites; many habitats, especially coastal
Andes grass			(<800m)
Cortaderia selloana		A-1	Disturbed sites
Pampas grass			(<300m)
Crupina vulgaris	A	Red Alert	Grassy places
Bearded creeper			(+/- 250m)
Cuscuta spp. (except *C. reflexa*)	C		Parasitic
Dodder			(<2500m)
Cyperus esculentus	B		Croplands, disturbed places
Yellow nutsedge			(<1000m)
Cyperus rotundus	B		Disturbed soils, croplands
Purple nutsedge			(<250m)
Cynodon dactylon	C		Disturbed sites
Bermuda grass			(<900m)
Cytisus scoparius	C	A-1	Disturbed places
Scotch broom			(<1000m)
Egeria densa		A-2	Streams, ponds, sloughs
Brazilian waterweed			(<2200m)
Eichhornia crassipes		A-2	Ponds, sloughs, waterways
Water hyacinth			(<200m)
Festuca arundinacea		B	Disturbed places
Tall fescue			(<2700m)
Ficus carica		A-2	Disturbed, moist areas
Edible fig			(<800m)
Foeniculum vulgare		A-1	Roadsides, waste places
Wild fennel			(<350m)
Genista monspessulana	C	A-1	Disturbed places in foothills
French broom			(<550m)
Hedera helix		B	Disturbed places
English ivy			(<1000m)

Scientific Name Common Name	CDFA List[1]	CalEPPC List[2]	Habitat (elevation)
Holcus lanatus Common velvet grass		B	Moist sites, roadbanks, cultivated fields, meadows (100-2300m)
Hydrilla verticillata Hydrilla	A	Red Alert	Ditches, canals, ponds, reservoirs, lakes (<200m)
Hypericum perforatum Klamathweed	C	B	Pastures, abandoned fields, disturbed places (<1500m)
Iris pseudacorus Water Iris		B	Irrigation ditches, pond margins (<100m)
Isatis tinctoria Dyer's woad	B		Roadsides, fields, disturbed sites (<1000m)
Leucanthemum vulgare Ox-eye daisy		B	Roadsides, fields (<2000m)
Lepidium latifolium Broad-leaved peppergrass	B	A-1	Saline soils, roadsides (<1900m)
Linaria genistifolia ssp. *dalmatica* Dalmation toadflax	A		Disturbed places, pastures, fields; (gen <1000m)
Lythrum salicaria Purple loosestrife	B	Red Alert	Marshes, ponds, streambanks, ditches (<1000m)
Malvella leprosa Alkali mallow	C		Valleys, orchards, saline soils (<1000m)
Mentha pulegium Pennyroyal		A-2	Moist areas, ditches (<1000m)
Myriophyllum aquaticum Parrot's feather		B	Ponds, ditches, streams, lakes, (<500m)
Olea europaea Olive		B	Disturbed places (<200m)
Phalaris aquatica Harding grass		B	Wet areas, ditches (<1200m)
Polygonum amphibium var *emersum* Kelp	C		Shallow lakes, streams, shores (<1500m)
Potamogeton crispus Crispate-leaved pondweed		B	Shallow water, ponds, reservoirs, streams (<2100m)
Robinia pseudoacacia Black locust		B	Roadsides, canyon slopes, stream banks (50-1900m)
Rubus discolor Himalayan blackberry		A-1	Disturbed moist areas (<1600m)
Salsola paulsenii Tumbleweed	C		Disturbed places (700-1800m)
Salsola tragus Common russian thistle	C		Disturbed places (<2700m)
Sapium sebiferum Chinese tallow tree		Red Alert	Along streams, wetlands (<100m)
Saponaria officinalis		A-2	Roadsides, oak woodlands,streambeds,

Scientific Name Common Name	CDFA List[1]	CalEPPC List[2]	Habitat (elevation)
Bouncing bet			disturbed areas (<1500m)
Senecio jacobaea	B	B	Pastures, disturbed places
Tansy ragwort			(<1600m)
Sesbania punicea		Red Alert	Banks of ditches and streams; wet roadsides
Scarlet wisteria tree			(30-330m)
Solanum elaeagnifolium	B		Dry, disturbed places
Hoary horsenettle			fields (<1200m)
Sorghum halepense	C		Disturbed areas, ditchbanks,
Johnson grass			roadsides (<800m)
Spartium junceum		B	Disturbed areas
Spanish broom			(<600m)
Taeniatherum caput-medusae	C	A-1	Grassy slopes and flats
Medusa-head			
Tamarix parviflora, T. ramosissima		A-1	Washes, streambanks, ditches
Tamarisk, salt cedar			(<800m)
Tribulus terrestris	C		Roadsides, railways, vacant lots,
Puncturevine			dry, disturbed areas (<100m)
Ulex europaeus		A-1	Disturbed areas; fields and pastures
Gorse			(<400m)
Verbascum thapsus		B	Disturbed areas
Wooly mullein			(<2200m)
Vinca major		B	Sheltered places, especially along
Periwinkle			streams (2-200m)

[1]California Department of Food & Agriculture List of Noxious Weeds: List A - Most invasive wildland pest plants - eradication, containment or other holding action at the state-county level; List B - Includes species less widespread and more difficult to contain - eradication, containment, control or other holding action at the discretion of the Commissioner: List C - Weeds that are so widespread that the agency does not endorse state or county-funded eradication except in nurseries.

[2]California Exotic Pest Plant Council List of Exotic Pest Plants of Greatest Ecological Concern: List A-1 - Most Invasive wildland pest plants, widespread; List A-2 - Most invasive wildland pest plants, regional; List B: Wildland pest plants of lesser invasiveness; List Red Alert: Species with potential to spread explosively, infestation currently restricted.

Literature surveys for each of the species in Table 5.1-1 have been conducted. Information on the biology/ecology, control measures, and local management activities for a few important noxious weed species known to occur in the Project Area have been completed and are presented below.

5.1.1 Species:

5.1.1.1 Purple loosestrife (Lythrum salicaria)

Listing status: CDFA List B: Cal EPPC List Red Alert

Background/habitat: Purple loosestrife is a perennial herb in the loosestrife family. It is native to Eurasia and was first introduced into the United States in the early 1800s as an ornamental and medicinal herb. It has subsequently spread throughout the northeastern U.S., southern Canada, parts of the Midwest, and in scattered locations throughout the west including British Columbia, California, and Oregon. It has currently been found in 42 states and is rated as a serious pest in most.

Biology: Purple loosestrife is typically 0.3-1.5 m (1-5 ft) tall but in nutrient-rich soils may reach 3 m (10 ft) in height. The showy spike-like inflorescence consists of numerous rose-purple flowers and blooms from July to September. It spreads primarily by seed but will also spread by the resprouting of cut stems or roots (Ducks Unlimited Canada Website 2000). Each plant produces numerous tiny seeds that are transported along waterways. It tolerates a wide range of environmental conditions including fluctuating water levels.

Ecological threats: Purple loosestrife is common in disturbed wetland habitats including stream and river banks, edges of ponds, lakes, and reservoirs, flooded area, ditches and roadsides as well as marshes, wet prairies, meadows, and bogs (Bossard 2000) Its rapid growth and enormous reproductive capacity allow it to spread rapidly and outcompete native plants. In its native range, natural predators control population spread. In the U.S., purple loosestrife replaces native plant species and forms dense stands that are unsuitable as cover, food, or nesting sites for a wide range of native animal species (State of Iowa Website 2000).

Control methods: Control of purple loosestrife depends on the age and size of the infestation, the importance of impacts to non-targeted species, and the type and amount of resources available. All methods require appropriate timing and follow-up control and monitoring. Physical control may be used in areas with small localized stands (up to 100 plants). The plants may be pulled or dug up by the roots. Cutting or burning is not effective and may result in loosestrife reestablishment. Several biological control agents have the potential to aid in the control of purple loosestrife. These include both a root-mining weevil, a flower-feeding beetle, and two species of leaf-eating beetles (*Galerucella* spp.). These have shown positive results, however, further research on *Galerucella* spp. in California is necessary before large-scale release is approved. In other states, it has taken four to six years for *Galerucella* spp to become fully established (Bossard 2000). Glyphosate (Rodeo/Roundup) is the most common herbicide used to control purple loosestrife. Glyphosate is a non-selective herbicide that kills all of the vegetation, including surrounding native vegetation that is critical in the recolonization of the site. Broadcast spraying of non-selective herbicides could result in

an increase in loosestrife density (Bender 1987). Glyphosate can be applied by hand sprayers which decreases the impact to surrounding vegetation, however, this method is more time consuming and labor intensive. The herbicide triclopyr (Garlon 3A or Renovate) is undergoing evaluation for use in aquatic environments. The advantage of triclopyr is it is selective for broadleaf plants and does not harm grasses and most other monocots, such as rushes and sedges, which are important in wetland habitats. However, it is not yet approved for aquatic use.

Local management measures specific to purple loosestrife:

CDFA - Studies have been conducted using biological agents in the project area by the California Department of Food and Agriculture (CDFA Website 2001). In 1996 and 1997, eggs of a root-boring weevil were placed in cut stems of purple loosestrife in the project vicinity. Establishment of the insects has not been confirmed. Significant flooding may have adversely affected their establishment. Additionally, the leaf-feeding beetles (Galerucella spp.) have been released into loosestrife stands in the project area in 1998, 2000, and 2001.

California Department of Parks and Recreation (DPR) – With funds provided by SB 1740 and in-kind services provided by CDFA, DPR has conducted mapping and control efforts for purple loosestrife in the area of the Thermalito Forebay, the Diversion Pool, and the area between the Diversion Pool and the Fish Barrier Dam. In August 2000, the shoreline and riparian areas were mapped. In July 2001, approximately 3.0 miles of Thermalito Forebay and Diversion Pool shoreline were treated with the herbicide Rodeo by use of a Gator-mounted 50-gallon spray rig and an airboat provided and operated by CDFA. In 2002, the area was again sprayed by airboat. The loosestrife was found in roughly the same shoreline distribution, but much reduced in number. The total herbicide use in 2002, was less than half of that used in 2001 (Dempsey 2001 and 2002).

California Department of Fish and Game (DFG) –With funds provided by SB 1740 and in-kind services provided by CDFA, DWR, and the Butte County Agriculture Department, DFG conducted loosestrife treatment around the Thermalito Afterbay and portions of the Oroville Wildlife Area (OWA). In July 2002, the shoreline of the Thermalito Afterbay was treated by helicopter with the herbicide Rodeo. Two weeks later, purple loosestrife was spot sprayed by boat along both sides of the Feather River from the Hwy 162 bridge south to the end of the OWA (pers. comm. B. Stone, 2003). No official pre- or post-monitoring has been conducted to rate the effectiveness of the application or its effect on associated plant species or habitat.

5.1.1.2 Giant Reed (Arundo donax)

Listing status: CDFA List A; Cal EPPC List A-1

Background/habitat: Giant reed is a tall perennial cane-like grass that grows in moist places such as ditches, streams, and riverbanks. It grows best in well-drained soils but tolerates both high salinity and harsh soil types. It is believed to be native to freshwater areas of eastern Asia, but has been cultivated throughout the Mediterranean region for thousands of years. It was introduced to California in the 1820s in the Los Angeles area as an erosion-control agent in drainage canals. It is cultivated as an ornamental and widely planted for erosion control throughout the south. Giant reed is an invasive pest throughout the warmer coastal freshwater areas of the U.S. from Maryland to northern California. It has a variety of uses including medicinal, basketry, fishing rods, and music. (Bell 1997; The National Park Service Website 2003; Hoshovsky 1986; The Santa Margarita and San Luis Rey Watersheds Management Area Website 2003).

Giant reed grows from 3-8 m in height. The flowers are born in large plume-like panicles between March and September. Although the inflorescence is large and showy, it is reported that in areas where it has been introduced, giant reed does not produce viable seed. The stems and leaves are large and may remain green throughout the year, but normally turn brownish during the winter months (The Santa Margarita and San Luis Rey Watersheds Management Area Website 2003). The creeping root stocks form compact masses of rhizomes (underground stems). These clonal rhizome masses can spread and sprout readily.

Ecological threats: Giant reed is one of the fastest growing land plants in the world and uses vast amounts of water. This combined rate of growth and vegetative reproduction enables it to quickly invade new areas. Once established, it can outcompete and suppress native vegetation. It is highly flammable during most of the year and resprouts aggressively after fire. Fire is a natural occurrence in most vegetation communities in California, however, it is largely unnatural and a serious threat to riparian communities. The extreme flammability of giant reed increases the probability of fire. Giant reed along with other non-native species can quickly colonize and outcompete native plant species, which in turn can effectively change the riparian community. Evidence indicates it provides neither food nor habitat for native wildlife species. Recent studies suggest stands of giant reed lacks the canopy structure necessary to provide significant shading of bank-edge riverine habitats. This results in warmer waters than generally found with native cottonwood or willow forests (Team Arundo del Norte Website 2003). The stems and leaves contain several toxic or unpalatable chemicals which probably protect it from herbivory and insect predation.

In northern California, invasion of giant reed is relatively recent and less severe than other regions. In Southern California, it sometimes occupies entire river channels from bank to bank, covering tens of thousands of acres (Bell 1997, Team Arundo del Norte – A Landowner Handbook Website 2003). Giant reed is spreading in northern California and several large areas of solid or near-solid stands do exist.

Control Methods: Control of giant reed usually involves more than one method and is dependent on the size of the infestation and the presence of native vegetation. All methods require follow-up control and monitoring. Manual control involves cutting the stems above the base and removing the biomass. Plants can also be dug up to remove the roots. This method disturbs the soil and may help cause erosion. Roots that were missed or cut can also sprout or be carried downstream. The chemical glyphosate (Roundup® or Rodeo®) is the most commonly used herbicide on giant reed. This systemic herbicide is absorbed by plant leaves and stems and is transported to the plant's root system where it kills the entire plant. According to Bell (1986), application is most effective during mid-August to early November when the plants are actively translocating nutrients to the rootmass in preparation for winter dormancy. In taller or large stands of giant reed, one approach is to cut the stalks and remove the biomass, wait three to six weeks for the plants to grow and then apply a foliar spray of herbicide. This requires less herbicide and has less chance of overspray onto associated native plant species. This approach may require more follow up applications. Another effective herbicide application involves cutting the stalks and applying undiluted glyphosate directly to the stump. Little is known about the use of various pathogens and insects on the growth and reproduction of giant reed in California. The USDA has not approved any biological control agents for use against giant reed in California. All methods require removal or disposal of the cut cane since they are still viable and capable of reestablishment. These can be stacked for composting, chipped, burned, or hauled away from the site.

5.1.1.3 Yellow starthistle (Centaurea solstitialis)

Listing status: CDFA List C; Cal EPPC List A-1

Background/habitat: Yellow starthistle is a deep-taprooted winter annual or occasionally a short-lived perennial member of the composite family (Asteraceae). It thrives in areas with hot, dry summers and well-drained soils, especially where disturbance has occurred. A native of Eurasia, it was first collected in Oakland, California in 1869. By 1917 it had become a serious weed in the Sacramento Valley, spreading rapidly (Bossard 2000). It had spread to over a million acres of California by the late 1950s and nearly two million acres by 1965. In 1985, it was estimated to cover eight million acres and over 10 million acres a decade later. Yellow starthistle is established in 23 states, but is most problematic in California. Human activities are the primary mechanisms for seed transport (Bossard 2000).

Biology: Yellow starthistle grows from 15-200 cm in height. The inflorescence is produced in late May to December and consists of one to many solitary spiny yellow-flowered heads. Plants are able to regrow and produce flowers after mowing or grazing. Seed output can be high with about 95 percent of the seed being viable. Most seeds germinate the following year after the first fall rains, but can persist as viable seed in the soil for up to 10 years (CDFA 2002). Seed dispersal is mainly by humans

and animals, the stiff hair-like barbs on the fruit adhere to clothing and to the hair and fur of animals.

Ecological threats: Yellow starthistle infestations displace native plants and decrease wildlife habitat. Once it colonizes an area, it can quickly spread. Often after control measures have been implemented, it will recolonize the area from adjacent infested lands, developed seed banks, and/or lack of competitive vegetation. Recent studies indicate it also significantly depletes soil moisture reserves in annual grasslands (UC Davis Weed Research and Information Center Website 2003). It is a pest in agricultural lands, reduces pasture production, and is toxic to horses under long-term use.

Control Methods: No individual method will control yellow starthistle and multiple treatments and persistence is required. Mechanical methods of control involve both tilling, mowing, and prescribed burning. Tilling the land can expose more disturbed surface area to invasion by the starthistle. Mowing and burning can be beneficial if conducted at the proper time of year, usually after native plants have dispersed their seed, and prior to starthistle setting seed. Burning is the preferred control technique by many agencies and organization. A number of biological control agents have been established in California. These include three weevils and three flies. All attack the flower heads and the larvae feed on the developing seeds. However, these insects do not appear to have significantly reduced the yellow starthistle populations. Other agents that are currently being studied include a root-attacking flea beetle and three fungal pathogens. Grazing by cattle, sheep, and goats can reduce biomass and seed production and dense revegetation with legumes and/or grasses may restrict starthistle expansion. Several non-selective pre-emergence herbicides registered in California will control yellow starthistle, however, these can only be used on right-of-ways or industrial sites and cannot be used in natural ecosystems. A limited number of post-emergence herbicides are registered for use in natural ecosystems and rangelands in California (Bossard 2000; UC Davis Weed Research and Information Center Website 2003).

5.1.1.4 Tree-of-heaven (Ailanthus altissima)

Listing status: Cal EPPC List B

Background/habitat: Tree-of-heaven is a rapidly growing, deciduous tree in the mostly tropical family Simaroubaceae. Native to China, it was first introduced in the U.S. in 1784 and by 1840 was commonly available from nurseries. During the gold rush, Chinese miners are thought to have brought seeds with them as they settled in California. It was planted throughout the U.S. during the last century, however, its popularity as an ornamental has declined. In California it is widely naturalized in cismontane areas of the Coast Range, Sierran foothills, and Central Valley below 2000 m (6,600 ft) in elevation. It is found mainly in wastelands and disturbed, semi-natural habitats, however, it also occurs in riparian and other naturally disturbed habitats (Bossard 2000).

Biology: Tree-of-heaven reproduces both sexually and asexually. Flowering occurs in late spring, seeds ripen in the fall, and may persist on the plants through the next winter. Seedlings establish themselves by producing a well-formed taproot in less than three months. Trees can also produce numerous suckers from the roots and resprout vigorously from cut stumps and root fragments (The National Park Service Website 2002; Bossard 2000; Hoshovsky 1988).

Ecological threats: Tree-of-heaven is a prolific seed producer, grows rapidly, and resprouts vigorously. It can successfully outcompete native vegetation, especially in riparian areas, and can quickly take over a site. It produces toxic chemicals that inhibit the establishment of other species. In urban areas, it can disrupt sidewalks, parking lots, and streets.

Control methods: Control methods for tree-of-heaven usually require more than one method, multiple-year treatments, and follow-up monitoring. Physical controls involve hand pulling; cutting or girdling the trees; hand digging to remove all parts of the tree including the roots; and prescribed burns. Because these trees are prolific stump and root sprouters, additional control measures are necessary with each of these treatments. Chemical control involves application to the leaves, basal bark, cut stumps, or injected into wounds or cuts. Foliar sprays should not be used where non-target species are nearby. Herbicides applied directly to the tops of freshly cut stumps is probably the most effective technique with little chance for damage to adjacent vegetation. Bossard (2000) recommends wiping the stumps within several minutes of cutting with full strength, 41 percent glyphosate. Biological control of tree-of-heaven is not addressed to any extent in any of the literature. No insects or diseases are known to significantly affect tree-of-heaven. All types of control should include a plan a revegetation plan for the disturbed sites.

5.1.1.5 Rush skeletonweed (Chondrilla juncea)

Listing status: CDFA List A

Background/habitat: Rush skeletonweed is a herbaceous perennial or biennial member of the sunflower family. Introduced from Eurasia prior to the 1870s, rush skeletonweed continues to expand its range. Heavy infestations are found in parts of California, Oregon, Idaho, and E. Washington. It was previously eradicated from Butte County, however, a new population was discovered last summer (2002) in the Project Area near the Enterprise Bridge and on adjacent Plumas National Forest lands (Katz 2002). Over 1000 plants were located. It inhabits disturbed soils of roadsides, croplands, irrigated fields, rangelands, and residential properties (CDFA Website 2003). It tolerates a wide range of environmental conditions, including low rainfall and extreme temperatures.

Biology: Rush skeletonweed is a member of the chicory tribe. It is a wiry plant up to 1 m tall with milky sap and somewhat resembles a dandelion. Reproduction is by both vegetative growth and seed. The long slender taproot can produce adventitious buds near the top from which new lateral roots can produce new rosettes. The roots are also easily fragmented from which new rosettes can also arise. Flowering begins in July and lasts until winter and produces seeds without fertilization. This produces clones of the parent plant, resulting in well-adapted plants that can quickly dominate an area. The seeds are numerous and are often carried by wind.

Ecological threats: Rush skeleton plants are highly competitive for water and nutrients. It grows best on well-drained, light-textured soils and is a threat to grasslands, grain fields, and pastures. It is likely to establish along roadsides and right of ways, and spread to the surrounding areas.

Control Methods: Mechanical measures include tilling the soil and mowing. Neither are recommended and could increase vegetation spread and seed dispersal. Three organisms have been released for control of rush skeletonweed in California – two gall mites and a rust. The rust has demonstrated considerable success in California (CDFA Website). There are few herbicides available for use on rush skeletonweed. Repeat treatments are necessary to be effective.

5.1.1.6 Scarlet wisteria (*Sesbania punicea*)

Listing status: Cal EPPC List Red Alert

Background/habitat: Scarlet wisteria is a deciduous riparian shrub or small tree in the legume family. It is native to South America and is sold as an ornamental. It is considered a serious pest in South Africa. In the U.S., it has invaded native habitat in Florida, Georgia to E. Texas, and recently in the central valley of California. This species range is expanding and has only recently been added to the Cal EPPC list. In Butte County, it is known to occur in both the OWA and along the Feather River near Oroville (Oswald 1994, Hickman 1993). Available information on this species is limited, however, efforts are underway throughout its current range to map and control the current infestation before it expands further.

Biology: Scarlet wisteria can grow up to 4 m tall. It has showy bright red flowers and produces hundreds of seedpods throughout the summer and fall. These persist after leaf fall through the winter. Once the pods fall, they are dispersed by water.

Ecological threats: Scarlet wisteria forms solid stands along riverbanks, displacing native vegetation and wildlife habitat. Each plant produces numerous seeds, which in turn can potentially travel great distances by water. All parts of the plant, particularly the seeds, are poisonous to mammals, birds, and reptiles.

Control methods: Mechanical measures include pulling young plants by hand or with a weed wrench. Larger trees can be cut and the stumps treated with an herbicide. Three biocontrol agents are used against scarlet wisteria in South Africa, but no information is available for California. (The Nature Conservancy Website 2002; The San Joaquin River Parkway and Conservation Trust Website 2003; pers. comm. Fallscheer 2002).

5.2 TASK 2/TASK 3: Species surveys and data collection/data entry

Noxious weed species have been mapped concurrently with other studies (T2, T3/5, and T4). These locations have been partly entered into a computer GIS and database. Mapping will continue through the 2003 field season.

Table 5.2-1 includes weed species that have been mapped and entered into a GIS, including the number of occurrences and the approximate acreage of each species. Most of the species that have been mapped to date are larger woody species and could be mapped as individual occurrences. Tree-of-heaven was mapped both as single occurrences and as polygons with a percent cover in areas where it was mixed with other vegetation and impossible to map the individual plants. Most herbaceous individuals were or will be mapped as a percent cover.

Table 5.2-1. noxious weed occurrences (mapped to date) and approximate acreages within the project-affected area.

Species/common name	# of Occurrences	Approximate Acreage
Ailanthus altissima / tree-of-heaven	725	17
Arundo donax / giant reed	109	2.5
Centaurea solstitialis / yellow starthistle	11	6
Cortaderia selloana / pampas grass	49	0.3
Ficus carica / fig	33	0.7
Robinia pseudoacacia / locust	14	0.5
Sesbania punicea / scarlet wisteria	82	1.5

Although purple loosestrife occurrences have not been entered into the GIS yet, portions of the Feather River and the adjacent portions of the OWA have been field mapped. It occurs in scattered locations along the Feather River downstream to the

Sacramento River and throughout the OWA. No information is available as to the effectiveness of the treatment conducted in 2002. Mapping has not been conducted around the Thermalito Afterbay, however, it does occur throughout the emergent zone. No occurrences have been seen around Lake Oroville. Mapping will continue during the summer of 2003.

One hundred and nine occurrences of giant reed have been mapped in the OWA to date. Field mapping has been done for much of the Feather River downstream to the confluence with the Sacramento River, however, these locations have not been tallied or entered into a GIS. Although giant reed is common in the OWA, most occurrences are spot locations, and at this time, do not form large, continuous stands. Giant reed occurs downstream along both sides of the Feather River, however, occurrences are larger and more frequent below Yuba City. A few locations have been mapped around Lake Oroville, mainly in the South Fork Feather River area.

Yellow starthistle occurs throughout the project area, both within open areas of riparian zones, woodlands, grasslands, and disturbed areas. Because starthistle occurs in almost every habitat (except very moist), it will be mapped as percent cover. Areas with no starthistle will also be mapped. Mapping will occur during the 2003 field season.

Tree-of-heaven occurs throughout the Project Area. It occurs in scattered locations around Lake Oroville, throughout the OWA, scattered along the Feather River and around the Afterbay, and in urban disturbed areas. It is especially abundant throughout the OWA and seems to spread rapidly in areas following a burn. This species is common in areas where the valley elderberry occurs.

Scarlet wisteria occurs throughout the OWA and is common along the gravel bars in the low flow section of the Feather River. It occurs in scattered locations along the banks downstream to the confluence with the Sacramento River. The largest concentrations are within the Project Area.

Other non-native species such as pampas grass, fig, and locust are common throughout the OWA, but not widespread.

6.0 ANALYSES

6.1 EXISTING CONDITIONS/ENVIRONMENTAL SETTING

Noxious weed species occur throughout the project area. Many of these species are common throughout California. Although mapping is not complete, most species on the list have been noted to occur in the project area and most of the species have been in the area for years. Others, such as scarlet wisteria, have appeared only recently, and are beginning to spread. Species on these lists are rated as pests for different reasons; some may be important agricultural pests, others specifically impact habitat important for special status species. Almost all impact native plant community structure and wildlife habitat, including riparian and wetland communities.

A few of the species that occur in the project area are included in state-wide eradication efforts. These include giant reed and purple loosestrife. Scarlet wisteria is an example of a species that has recently begun to spread. It is rapidly invading riparian vegetation along the Feather River and is reported as a problem in the Delta and along the American and San Joaquin Rivers. Mapping and eradication efforts are underway in those areas to help prevent its spread. The OWA and the Feather River are thought to be the source of seeds for the downstream invasion by some agencies/organizations that work in the Delta. Portions of the gravel bars along the Feather River in the low-flow portion have extensive linear stands of scarlet wisteria along the waters edge. Downstream of the Thermalito Outlet, these plants occur mostly away from the waters edge and as single occurrences. The consistent flow in the low-flow reach may enable the plant to establish and thrive under these conditions. Below the Thermalito Outlet, flushing flows do not allow the plant to establish in large colonies or near the waters edge.

There does not seem to be a large upstream source of these species. Thus eradication efforts are likely to be more effective than efforts in an area that has potential to be continually reinfested from upstream sources. However, any efforts to control these species will need to have follow-up control and monitoring. These efforts should decrease over time, as populations decline.

Tree-of-heaven is a species that occurs throughout the project area, as well as upstream of Lake Oroville. Although complete containment is highly unlikely, efforts to remove stands in the OWA should be attempted. It is aggressively impacting native riparian vegetation, and special status species habitat. This too will require repeat efforts and monitoring.

6.2 PROJECT RELATED EFFECTS

A complete analysis under Task 4, an evaluation of project effects and management strategies, will be completed in the final report.

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APPENDICES